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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/734,328	12/12/2003	Mohammed Shaarawi	200309536-1	1352

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EXAMINER	
RAYMOND, BRITTANY L	
ART UNIT	PAPER NUMBER
1795	

NOTIFICATION DATE	DELIVERY MODE
05/14/2009	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/734,328	SHAARAWI ET AL.	
	Examiner	Art Unit	
	BRITTANY RAYMOND	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *28 January 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1 and 3-54* is/are pending in the application.

4a) Of the above claim(s) *53 and 54* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1 and 3-52* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *12 December 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 1 and 3-52 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 1, 11 and 31 use the phrase, "wherein the method is performed such that one of:" which is not complete. This should be replaced with something similar to, "wherein the method is performed such that one of the following is true:"

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

4. Claims 1, 6, 11, 12, 16, 21, 22 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ulrich (U.S. Patent 5753417) in view of Tashiro (U.S. Patent Publication 2004/0257506).

Ulrich discloses a method of making a resist pattern comprising: placing a single layer of photoresist onto a substrate, directing light to the photoresist through a first mask, directing light to the photoresist through a second mask, wherein the second exposure has a higher level of light, and developing the photoresist layer to form interconnect and via patterns (Column 6, Line 20-Column 7, Line 55), as recited in claims 1 and 11 of the present invention. While Ulrich does not teach if the photoresist is positive or negative, it is clear from Figures 2-4 that the photoresist is positive. Since the same pattern is formed in the photoresist of Ulrich as compared to the present invention and the opposite type of photoresist is used, this means that the process of Ulrich would have to be the opposite of what is recited in the present invention. Therefore, the exposure dose being higher in the via area of Ulrich would be equivalent to the exposure dose being lower in the via area of the present invention, as recited in claims 1 and 11 of the present invention. Also, Ulrich shows in Figure 2 that the pattern of the first mask has a non-transmissive portion, which corresponds to the first portion of the present invention, and a transmissive portion, which corresponds to the second and third portions of the present invention. Ulrich shows in Figure 3 that the pattern of the second mask has a non-transmissive portion, which corresponds to the first and second portions of the present invention, and a transmissive portion, which corresponds to the third portion of the present invention. The first and second masks of Ulrich are the

opposite of what is claimed in the present invention because the photoresist of Ulrich is positive, whereas the photoresist of the present invention is negative. If the photoresist of Ulrich were negative, then the masks would match what is claimed in claims 6 and 16 of the present invention. It is apparent from Figure 5 that the third portion is enclosed within the second portion, as recited in claim 12 of the present invention. When the masks are exposed together, they have transmissive, partially transmissive and non-transmissive portions that expose the three different portions of the resist, as stated in claim 29 of the present invention. In claim 6 of Ulrich, the steps of the process are written as if the order of the two exposures is not important as long as the interconnect and via patterns are formed at the end of the process. Therefore, the via area could be exposed first or second, as recited in claims 21 and 22 of the present invention.

Ulrich fails to disclose that a baking step forms a depression at the surface of the layer in the first or second portion of the layer.

Tashiro discloses an embodiment for forming a liquid crystal display device comprising: forming a photosensitive resin on a substrate surface, prebaking the substrate, irradiating the photosensitive resin with ultraviolet light, and a first and second bake that are used to form projections and depressions in the photosensitive resin layer (Paragraph 0206), as recited in claims 1 and 11 of the present invention.

It would have been obvious to one of ordinary skill in this art, at the time of invention by applicant, to have used the baking step to form the depression in the surface of the layer, as suggested by Tashiro, in the process of Ulrich because Tashiro teaches that a baking step can be used to form depressions in areas of a photosensitive

layer that have been exposed to radiation, in order to produce a differently shaped pattern.

5. Claim 3-5, 23-28 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ulrich (U.S. Patent 5753417) in view of Tashiro (U.S. Patent Publication 2004/0257506) as applied to claims 1, 6, 11, 12, 16, 21, 22 and 29 above, and further in view of Cauchi (U.S. Patent Application 2004/0101790).

The teachings of Ulrich and Tashiro have been discussed in paragraph 4 above.

Ulrich and Tashiro fail to disclose that the photoresist layer is baked at a temperature in the range of 80-120 degrees Celsius, that it is baked for up to five minutes, that the layer is baked after the first exposure and after the second exposure, and that the photoresist is negative.

Cauchi ('790) discloses a photoresist exposure process that has two exposures, each having a baking step afterwards (See Figure 2), as recited in claims 4, 5 and 23-26 of the present invention. Cauchi ('790) states that the baking takes place for 90 seconds at between 110 and 140 degrees Celsius (Paragraph 0027), which are within the ranges recited in claims 3, 27 and 28 of the present invention. Cauchi ('790) also states that a negative photoresist may be used in the process (Paragraph 0021), as recited in claim 30 of the present invention.

It would have been obvious to one of ordinary skill in this art, at the time of invention by applicant, to have modified the processes of Ulrich and Tashiro by having the baking step last in the range of 90 seconds long at a temperature around 110 to 140 degrees Celsius, as suggested by Cauchi ('790), because Cauchi ('790) teaches such

temperature and time ranges lead to an improved pattern in a lithographic process using two exposures at different exposure doses. It also would have been obvious to one of ordinary skill in the art to have performed two baking steps, one after each exposure, as suggested by Cauchi ('790), because Cauchi ('790) teaches that the baking steps promote solubility so that the development step can form a desirable photoresist pattern. It also would have been obvious to one of ordinary skill in the art to have used a negative photoresist, as suggested by Cauchi ('790), because Cauchi ('790) teaches that both positive and negative photoresists can be used in photolithographic processes with two exposures.

6. Claims 13-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ulrich (U.S. Patent 5753417) in view of Tashiro (U.S. Patent Publication 2004/0257506) as applied to claims 1, 6, 11, 12, 16, 21, 22 and 29 above, and further in view of Okoroanyanwu (U.S. Patent 6589713).

The teachings of Ulrich and Tashiro have been discussed in paragraph 4 above.

Ulrich and Tashiro fail to disclose that the void's lower portion and the depression have substantially circular cross-sections, the circumference of the void's lower portion is within the circumference of the depression, the depression has a generally parabolic shape, and the void's lower portion and the depression are substantially concentric.

Okoroanyanwu discloses a process for forming vias wherein radiation is provided through a mask to form an aperture, which can be circular in shape (Column 4, Line 35), as recited in claim 13 of the present invention. A step of etching is performed after this to form a circular hole within the aperture (Column 5, Lines 35-40), also recited in claim

13 of the present invention. When formed, the aperture can have a parabolic shape (See Figure 4), as recited in claim 14, and it is concentric with the circular hole (See Figure 15), as recited in claim 15.

It would have been obvious to one of ordinary skill in this art, at the time of invention by applicant, to have modified the methods of Ulrich and Tashiro by making the depression and void circular in shape, such as a parabolic shape for the depression, with the void lying within the depression, as suggested by Okoroanyanwu, because the purpose of the invention is to produce a fluid emitter and fluid is able to flow more easily through a shape with rounded edges. It would have also been obvious to have made the void and depression concentric, as suggested by Okoroanyanwu, because more fluid can be emitted at one time if the two have a common center.

7. Claims 31-36, 41-48, and 52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ulrich (U.S. Patent 5753417) in view of Tashiro (U.S. Patent Publication 2004/0257506), Okoroanyanwu (U.S. Patent 6589713), and/or Cauchi (U.S. Patent Application 2004/0101790) as applied to claims 1, 3-6, 11-16, and 21-30 above, and further in view of Makigaki (U.S. Patent 6863375).

The teachings of Ulrich, Tashiro, Okoroanyanwu and Cauchi ('790) have been discussed in paragraphs 4-6 above.

Ulrich, Tashiro, Okoroanyanwu and Cauchi ('790) fail to disclose forming a nozzle and counter bore in the photoresist layer.

Makigaki discloses a silicon nozzle plate that has nozzles each with a first nozzle portion and a second nozzle portion that both have circular cross-sections. The circular

cross-section of the first nozzle is smaller than the circular cross-section of the second nozzle portion (Claim 1). The first and second nozzle portions are formed by patterning a resist film, formed on a substrate (Claim 2). Makigaki also discloses that an ink supply hole, which is assumed to be similar to a counter bore, can be formed at the bottom of the nozzle (Column 6, Line 33).

It would have been obvious to one of ordinary skill in this art, at the time of invention by applicant, to have modified the methods of Ulrich, Tashiro, Okoroanyanwu, and Cauchi ('790) by further forming a nozzle and counter bore in the layer, as suggested by Makigaki, because Makigaki teaches that it is known to make a fluid emitting nozzle photolithographically using photoresist films.

8. Claims 7-10, 17-20, 37-40, and 49-51 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ulrich (U.S. Patent 5753417), Tashiro (U.S. Patent Publication 2004/0257506), Okoroanyanwu (U.S. Patent 6589713), and/or Cauchi (U.S. Patent Application 2004/0101790) as applied to claims, 1, 3-6, 11-16, 21-36, 41-48 and 52.

The teachings of Ulrich, Tashiro, Okoroanyanwu, and Cauchi ('790) have been taught in paragraphs 4-6 above.

Ulrich, Tashiro, Okoroanyanwu, and Cauchi ('790) fail to teach the range of doses recited in claims 7-10, 17-20, and 37-40. They also fail to teach the range of sizes recited in claims 49-51.

It would have been obvious to one of ordinary skill in this art, at the time of invention by applicant, to have used the range of doses and range of sizes recited in the claims being rejected because the range of exposure doses depends on the photoresist

being used and can be determined by one of ordinary skill in the art without undue experimentation to form the desired nozzle with the desired dimensions.

Response to Arguments

9. Applicant's arguments filed 1/28/2009 have been fully considered but they are not persuasive.

Applicant argues that Ulrich in view of Tashiro teaches performing two separate exposures followed by two post-exposure bakes, which does not suggest the claimed invention as has been amended. Tashiro is just being used to teach that after a photoresist layer has been exposed, a post-exposure bake can be performed in order to form depressions in the exposed or unexposed areas. Although Tashiro teaches that two post-exposure bakes are performed, it is apparent that these two bakes work together in order to completely form an accurate pattern in the photoresist, much like a single post-exposure bake. Also, it is apparent from the specification that the purpose of a single post-exposure bake in the present invention is to create patterns in the areas that were exposed in both of the exposure steps at one time, rather than creating them after each exposure. Since Tashiro only teaches one exposure, the first and second post-exposure bakes of Tashiro are not related to separate exposures performed on the photoresist layer. The post-exposure bakes of Tashiro can be used together to replace the development step of Ulrich because Tashiro teaches that post-exposure baking can form depressions in an exposed photoresist, much like a developer.

As discussed above, it is apparent that the post-exposure bakes of Tashiro can be equivalent to a single post-exposure bake, as required in the present invention.

Since this single post-exposure bake is taught be Ulrich and Tashiro and Ulrich teaches that the first and second exposures can be performed in any order, part (b) of the independent claims of the present invention has been taught.

Conclusion

10. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to BRITTANY RAYMOND whose telephone number is (571)272-6545. The examiner can normally be reached on Monday through Friday, 8:30 a.m. - 5:00 p.m. EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on 571-272-1385. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Kathleen Duda/
Primary Examiner, Art Unit 1795

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